Paratransit: the need for a regulatory revolution in the light of institutional inertia

Book Section

Paratransit and the need for a regulatory revolution in the light of institutional inertia

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Introduction

The chapter will firstly define what is traditionally meant by the term paratransit, before exploring why it has remained a relatively niche transport concern. It will then look at current societal trends and future developments before proposing a redefinition of paratransit and identifying institutional challenges for the future.

Defining paratransit

According to Vuchic (2007), paratransit can be characterised as being "urban passenger transport service mostly in highway vehicles operated on public streets in mixed traffic; it is provided by private or public transport operators and is available to certain groups of users or to the general public; but it is adaptable in its routeing and scheduling to individual user's desires in varying degrees" (p.501). In other words, paratransit routes may not be fixed and vehicles may not have timetables, yet are available to the general public and hence can be seen as falling into "the full spectrum of transportation options that fall between the private automobile and the conventional bus" (Cervero, 1997: p.14). Cervero continues that paratransit can "comprise a mix of service types and configurations, passenger-carrying levels, market orientations and levels of regulatory control", and states that example modes accordingly include both car rentals and carpools, in addition to taxis, DRT, jitneys, dial-a-ride services and subscription buses of various types.

Paratransit modes are potentially important because they can provide services in areas and/or at times where demand is not sufficient to economically justify conventional public transport modes such as a bus. In categorising how it does this, Enoch et al (2004) proposes four types of service, namely those developed as Interchange, Network, Destination Specific and Substitute. These are:

- Interchange services have evolved to act as feeder services to enable people living in relatively low density areas to access higher frequency bus and rail-based services. One example here is the Lincolnshire InterConnect scheme in the UK, which sees a whole number of Demand Responsive Transport (DRT) minibus services being timetabled to meet a network of interurban bus services connecting the larger settlements in what is by UK standards, a very rural county (Wang et al, 2015).
- Network services are slightly different in that they enhance public transport either by providing additional services, or by replacing uneconomic services in a particular place or at

certain times. One such example occurs on the Indian Ocean island of Mauritius. Here, so-called ‘taxi train’ services supplement inadequate bus services throughout the day, whereby taxis not on other duties and which are registered on a specific route corridor provide travellers with a shared taxi ride for a fare slightly higher than for an equivalent bus fare. These typically run from a main terminus point only when the vehicle is full, but otherwise cruise the route in order to solicit custom (Enoch, 2003). Similar paratransit services of relatively high capacity operated by taxis and/or minibuses also operate in countries as diverse as (limited areas in) the USA (jitneys); Russia (marshrutka), Kenya (matatu), Turkey (dolmus), Northern Ireland (black taxibuses), Hong Kong (public light buses), Philippines (jeepneys) and Tunisia (louage). Slightly different, the Helsinki ‘Kutsuplus’ uses a 9 seater minibus that can be ordered to a pickup point at a certain time. Other passengers will be already on board, picked up and dropped en-route. An algorithm calculates the most efficient route for drop off for everyone but each passenger only pays for their trip via the shortest route.

Figure 1: A public light bus in Hong Kong

- Destination-specific services have been developed to serve special destinations such as employment locations or airports. Well known examples here include the airport shuttles that operate to most major USA airports, the Allobus, a DRT service which provides employees with a means of accessing Paris Charles de Gaulle Airport; and the Deeside Shuttle, which began operating in 2003 to transport employees from Merseyside to an industrial park in north Wales, but which at the time of writing was due to close down due to local authority funding cuts (Enoch et al, 2004; Porter, 2015).
- Substitute paratransit effectively reinvents public transport by replacing conventional public transport rather than complementing it. One of the best known examples of this type is the Taxibus scheme in Rimouski, Quebec, which saw the city authorities replace a stage bus network with a shared taxi operation for services to suburban areas in 1993 (Trudel, 1998).

Such nascent flexibility in the case of paratransit modes is rather different from the characteristics of the systems design of conventional public transport. The basic system design for conventional public transport is so long established that its core structure, characteristics and business model are taken for granted. This model has essentially remained unaltered since the development of the horse bus in the 1820s, and exists because, in order to operate at a viable fare, capital and labour costs need to be spread across a large number of passengers per vehicle. This business model means that vehicles need to be as large as possible (initially the maximum that could be hauled by two horses) and operate on corridors of high demand to set timetables. Services have always tended to focus on commuting and business trips along corridors into and within big cities. Passengers access the service by walking to stops, waiting until a vehicle arrives, then hailing the vehicle and boarding. Traditionally the fare was paid on board, but increasingly now fares are prepaid using smart/contactless card systems. At the end of the trip, the passenger then indicates the stop on the route where they wish to alight and from there walks to his/her final destination. It may seem odd to specify this system design, but it is perhaps remarkable that this model has essentially remained unaltered for 200 years, even though the technology of public transport vehicles, fare collection and any associated track and infrastructure, have seen considerable development over the period (Daganzo, 2010).

This being so, transport policy and debate has taken the present model of public transport as fixed and enduring. This 'big vehicle/big infrastructure/dense corridor' model is strongly engrained in public transport policy. Even when patterns of demand do not fit the model, passengers are expected to conform to the system. Hence the large vehicle is retained for peri-urban and rural services, but operates at low frequencies to build up user numbers. This acceptance of a single model for public transport (albeit varied in scale) has led equally to a single model to make transport in cities more sustainable.

Figure 2 Hong Kong Metro and high density living

The design of transport for sustainable cities is therefore structured around concepts to ensure dense clusters that can support high-capacity, corridor-based public transport. This is seen as the ideal urban transport/land-use pattern to constrain car use – intended to get people to arrange their habitat and lives around the service design requirements of a transport system (Figure 2). Planning controls are advocated to produce settlement patterns and conditions that will favour high-capacity, corridor-based public transport and discourage car use. High densities also bring more destinations within walking and cycling distance. Such an approach advocate high density cities structured around public transport systems to reduce car use (Newman and Kenworthy, 1999). In a comprehensive review of this and other approaches, Banister (2005, Chapter 6) cites case studies of cities that have achieved a 10% cut in car use through approaches utilising planning controls and public transport development.

But there is a crucial question of system design ethics here. Should sustainability result in people being required to arrange their lives around the service design requirements of a transport system? Additionally, much of the reluctance to using public transport is about the suitability of the basic service design for their needs. Although the product-level design of the service can been improved, the key to the problem is in the service design itself. For at least the last 100 years, travel behaviour has been moving away from high demand corridor configurations. Travel behaviour is driven by deep-rooted economic and social factors than lead to demand becoming increasingly dispersed in time, space and across functions. Transport planning focuses upon work journeys, which now constitute only 16% of all trips in the UK and business only 3% (National Travel Survey, 2014). Travel growth is now in leisure purposes (which has grown to 30% of all trips), shopping (20%) and highly dispersed personal business trips (20%). In space, the strongest growth is not along major city corridors, but in suburban, urban fringe and rural areas. The rise in car ownership and use has much to do with this dispersal of travel demand, but it is also a result of fundamental shifts in our economy and society. It is not something that can be explained by transport factors alone. Enhancing the quality and cutting the cost of corridor 'big vehicle' timetabled services will only have a marginal impact on car use when 80% or more of travel is no longer along high density corridors or is at times when corridor services are infrequent or not operating.

The fundamental problem is that travel behaviour continues to shift to a pattern of demand that is ill-suited to the system design for conventional public transport. In an article written shortly before his death, Sir Peter Hall reviewed the need for new form of public transport to effectively serve decentralised and dispersed travel demands, seeking what he called the 'Heineken' system (public transport that refreshes the parts other transport cannot reach), but could not find such a system (Hall, 2013). Crucially though, he restricted his consideration to public transport systems conforming to the existing system design. However, what if the answer lies in the rejection of such a system configuration, which is what paratransit represents?

The potentially transformative impact of 'small vehicle/small infrastructure paratransit public transport is that, rather than people needing to adjust their behaviour to a bus or metro, they can travel directly, whenever they want, on services that could well operate 24 hours a day, seven days a week. This is a service design that matches the socio-economic culture of the 21st century city – not one requiring 21st century society to conform to a 19th century transport architecture. A shift to a public transport service system of this type therefore has major implications for transport and urban planning. Although conventional corridor big vehicle systems can continue to serve the market for which they are suited, a small vehicle paratransit system could emerge to provide a viable alternative to private car use in suburban, urban fringe and rural situations. It is this system level change that has the potential to deliver energy and sustainability gains together with and greater social inclusion and economic benefits.

In essence then, paratransit modes are appealing because they are theoretically able to dynamically match the level of supply of a service with the level of demand required, unlike conventional models of public transport whereby supply is effectively supply-led, with operational decisions generally based on fading historical demand patterns.

Paratransit: A niche concern

Yet despite the potential scope and appropriateness of paratransit modes, in practice they have so far remained a niche concern. For instance, Balcombe et al (2004) suggests that taxis (the most widely available and established form of paratransit) accounted for 10% of all public transport trips in the UK and 6% of passenger kilometres, whilst a survey of British local authorities reveals there to be a relatively small number of Demand Responsive Transport schemes in operation (369 from a response rate of 47% of councils, crudely suggesting a total of around 800 DRT services across the country) compared with roughly 22,000 bus services – i.e. about 4% of services (Davison et al, 2014; Stagecoach, 2015).

Such a status has previously been ascribed to a three sets of barriers: technological, economic and institutional (Cervero, 1997; Enoch et al, 2004). In particular, technological challenges tended to relate to optimising the booking, scheduling, and routeing functions, whilst the economic issues focused on the business model for paratransit. In sum, small vehicles generally were not able to generate sufficient revenue from the relatively low numbers of passengers often paying relatively low fares to cover the still relatively high costs of provision (particularly the driver costs). Meanwhile the institutional barriers most frequently centred on (aspiring) operators navigating the diverse range of licensing regimes for operators, drivers, vehicles and routes or service areas, which in turn had major implications on insurance, subsidy, tax, VAT, safety and several other operational questions.

However, more recently rapid developments in big data ICT systems (especially increased computing power at much lower costs) have dramatically altered this landscape. The existing paratransit schemes, with their culture still dominated by structures built around stage carriage service thinking, have only gradually and marginally responded, but the minicab business and been quick to move into the world of booking apps and the internet, using it to significantly improve customer service. Added to this has been, often controversial, invaders from the world of the digital economy. This is epitomised by the technology company Uber and its new model of an on demand car service (Boeckel et al 2012). This new business model is strongly commercially driven and is far from the cumbersome structures used by niche paratransit operators to date. Uber's model involves a user-friendly booking and payment app, crowdsourced drivers, highly efficient scheduling and back-office software, which together outperform incumbent minicab operators and has invoked the politically powerful wrath of the hackney carriage taxi industry in cities around the world.

Behind all this is the emergence of big data IT systems. Passengers and service providers can now communicate directly with each other thanks to a 'marketplace of travel marketplaces' where trip demand needs and available transport supply alternatives can be matched or brokered almost instantaneously. Effectively, for some location types/time periods this could well lead to a sizeable proportion of users shifting from conventional public transport modes, which can be considered to be supply-led (being based on historic or indirect demand patterns) to a direct and dynamic demand-led system of new or rejuvenated paratransit. Additionally, even individual citizens can now accept fares paid by smart card, on a phone or contactless credit cards thanks to the availability of inexpensive fund transfer equipment. It is these sorts of digital economy developments and their associated business models that are behind many new transport services.

Big data IT-based systems are set to take paratransit well beyond the 'Ubersphere'. One major radical future influence centres on the emergence of autonomous or driverless vehicles. An existing example is the Heathrow Airport 'pods' introduced in 2011 to replace a bus service (Figure 3). So, instead of a big bus linking a number of stops along a fixed route before getting to the one nearest the users' car, the four-seat pod goes non-stop to the nearest station.

A number of companies are now producing such Personalised Rapid Transit (PRT) systems. Such systems have been proposed since the 1970s, but it is only now that affordable IT capability is making them a realistic proposition.

Figure 3 A Heathrow Pod at a car park stop

The service design for PRT is to operate individual journeys across a network of narrow tracks. It is effectively a driverless taxi. The battery-electric ‘pods’ wait for customers at local stops, and when one pod is occupied another automatically replaces it to await the next customer.

Outside of sheltered contexts, PRT systems are only being applied gradually. However the prospect is now emerging of autonomous PRT systems that do not require segregated tracks. Autonomous cars are already test running on streets in the USA and became street legal in the UK from 2015. The concept that PRT systems require separate trackways will soon no longer be needed as these vehicles should be able to run on ordinary streets. With the elimination of the cost of both driver and special infrastructure, the economics of small vehicle PRT systems are transformed – driver costs for bus and taxi services typically account for just less than half of operational costs (Enoch, 2015). They thus have the potential to offer a door-to-door 24/7 taxi level of service for the same fare as one would now pay for a bus journey.

Figure 4 The Milton Keynes two-seater pod

In pointing the way to this future, autonomous tourist passenger shuttle vehicle trials are about to start in the London Borough of Greenwich, together with autonomous valet parking for adapted cars. The Milton Keynes element of the *Autodrive* programme, which also involves a related project in Coventry, is led by the UK Transport Catapult and linked to the MK:Smart programme, and will have ‘Pathfinder’ autonomous pods running in trials from late 2015 on short-distance links from the station to destinations in Central Milton Keynes. These two-seat pods (Figure 4) will run on cycleways and footpaths, mixing with cyclists and pedestrians. Lastly, Bristol’s *Venture Consortium* will investigate whether autonomous vehicles might improve or worsen congestion, together with the safety aspects. The latter aspects have already stimulated much research interest (for example Rodoulis, 2014 and Burns, 2013).

All these developments mean that, through improved and more cheaply available technologies, many of the economic barriers for some forms of paratransit scheme, particularly for car-based and small vehicle services, have been reduced or eliminated. But the existing transport operators are not the ones who have recognised this. It is new digital economy companies and actors who have made the running.

Thus it is the industry structure and other institutional barriers that proved to provide perhaps the last, and most stubborn, remaining obstacles in preventing the rapid up take of paratransit systems. The new business models emerging behind new digital economy-led services are essentially commercial ones and they frequently clash not only with incumbent providers, but with the regulations and institutional structures that have been built up around the existing business models that the invaders are so strongly challenging.

Paratransit: Institutional challenges

In characterising these institutional issues, perhaps the most challenging to address relate to the fact that the regulatory environment for the local passenger sector has been built incrementally over many years and effectively around two, or possibly three, very separate institutional frameworks, namely:

1. Stage carriage services (i.e. buses). Buses tend to operate fixed routes and timetables and operate using larger vehicles. Bus companies are often eligible for various forms of subsidy payment, can bid for contracts to run various services and, in the UK and several other countries, there is no VAT on bus fares. However, they do face stringent rules on financial probity, and on vehicle and driver standards. In the UK context, bus service standards are monitored and enforced by a national agency known as the Traffic Commissioners, which is an agency of the national Government.
2. Public hire and private hire vehicles (i.e. taxis). Operators of taxis and minicabs are licensed to operate in specific areas, generally operate vehicles of less than nine seats, and can and do bid for some public transport contracts. While they pay VAT on fares and do not usually qualify for subsidy payments, the operator, vehicle and driver standards are probably less onerous than for bus companies. Taxis and minicabs are monitored and licensed by local district councils or unitary authorities.
3. Private vehicles (i.e. cars)[1]. Owners of private vehicles are not really supposed to provide transport for strangers for the purpose of financial gain, and so there are no systems in place to ensure that vehicles and/or drivers are of a suitable standard to transport passengers beyond the basic annual vehicle safety check and driving tests, which are administered by agencies of national Government.

The problem is that, almost by definition, paratransit alternatives often do not fully fit under any of these categorisations with the result that they often do not have an institutional home and thus either upset the status quo (as with Uber currently) or else are still born. Such challenges are not new in the paratransit sector. Indeed the story of the jitney in Los Angeles 100 years or so ago echoes the regulatory struggles of DRT operators around the turn of the Millennium in the UK to register new service types, and perhaps more closely the battles facing Uber currently all over the world (Nilsson, 2015).

Future developments

Looking to the future, Enoch (2015) suggests that there are several factors pushing away from the traditional modes of car, bus and taxi and towards increased role for paratransit-type modes. These include:

- more elderly people who will no longer be able to drive but who need access to places buses serve poorly; more younger people excluded from car ownership by high insurance costs and competing demands on their incomes;
- a growing culture of ‘collaborative consumption’;
- increasing pressures on the global economy and the impact of the austerity agenda in many countries on revenue budgets. Expensive public transport infrastructure projects will be difficult to fund and bus subsidies hard to justify compared to commercial paratransit;

[1] In addition it should be noted that increasing numbers of services in the UK are also being operated by community transport or social enterprise organisations, which are ‘not for profit’ organisations and therefore conform to yet another set of institutional rules.

- the political desires to deregulate policy sectors and promote 'choice' as a means of improving service quality;
- the increasingly blurred boundaries within the intermediate transport mode supplier sector and the increasing range of 'new mobility solutions';
- the increasing desire to better integrate transport options to create a more user friendly transport system, through spatial, temporal, ticketing, information and seat brokerage mechanisms; and
- the widespread adoption of big data technologies such as the internet, smartphone and GPS tracking technology.

To this needs to be added the structural factors mentioned at the beginning of this chapter – that of deep-rooted economic and social factors lead to travel demand becoming increasingly dispersed in time, space and across functions.

In recognising these broader 'market pull' and 'technology push' trends, one future for the current local passenger transport market could see the traditional landscape of bus, car and taxi being replaced, first by a range of paratransit modes, and ultimately, once driverless technology becomes mainstream, by a autonomous taxi-like 'dial-a-pod' systems through a process of 'convergence' (Enoch, 2015). Yet even if this is not the case, the current direction is towards a system where paratransit modes play a far more important role than currently in personal transport. Accordingly, there is a need for the current institutional structures to be revisited, and most likely rebuilt in a way that can be open to a new means of delivering transport services.

Redefining paratransit: Suggestions for institutional change

The approach mooted here is that the current modal-based institutional structures (bus, taxi, car) be realigned into a new format based on the degree of operator specialism[2] (occasional, regular, specialist), but that the day to day operation of the various regulatory functions (driver licensing, subsidy allocation, etc), would essentially remain unchanged and would in most cases only subject to refinements. Underlying this, are two core principles:

1. That 'new' modes would no longer be forced into operating pre-conceived service patterns (constrained, for example, by limitations on number of seats, timetable schedules, route/area restrictions); and
2. That the more specialist the operator, the tighter the regulations but the greater the operational benefits and opportunities.

The idea behind this is that such a system would be flexible enough to enable operators to design the transport operations that they deem to be most appropriate for the anticipated demand, and to select the minimum performance criteria against which they would be judged. Moreover, operators could potentially move up or down the continuum as the market or their circumstances changed, simply by deciding which criteria to meet.

[2] It should be noted that whilst these recommendations currently refer only to passenger transport, there is no reason why a parallel development could not take place for freight given that similarly transformative processes are also occurring in that sector.

Under the proposed new system, operators would be classed as being specialist, regular or occasional.

Typically, specialist operators would operate much like bus companies currently, with regular stringent checks on financial, maintenance, drivers and service levels, coupled with the opportunity to bid for the full range of contracted transport services, eligibility for subsidy schemes, exemption from VAT on fares and so on.

Meanwhile regular operators (perhaps including some minicab operators, subscription bus providers, or vanpool operations) would submit to slightly less onerous licensing arrangements across the board, but as a consequence would be restricted to bidding for a limited range of contracted services and subsidy sources, and would not be VAT exempt.

Finally, all other vehicle owners would be classified as being occasional operators. Under this designation, it is perceived that car drivers that offered lifts to people would be able to be reimbursed but would not be eligible for VAT reimbursement for example. On the other hand, they would not be subject to any additional administrative burdens to what they face currently in terms of driver and vehicle licensing requirements, insurance and so on.

Figure 5 illustrates how this concept may look in practice.

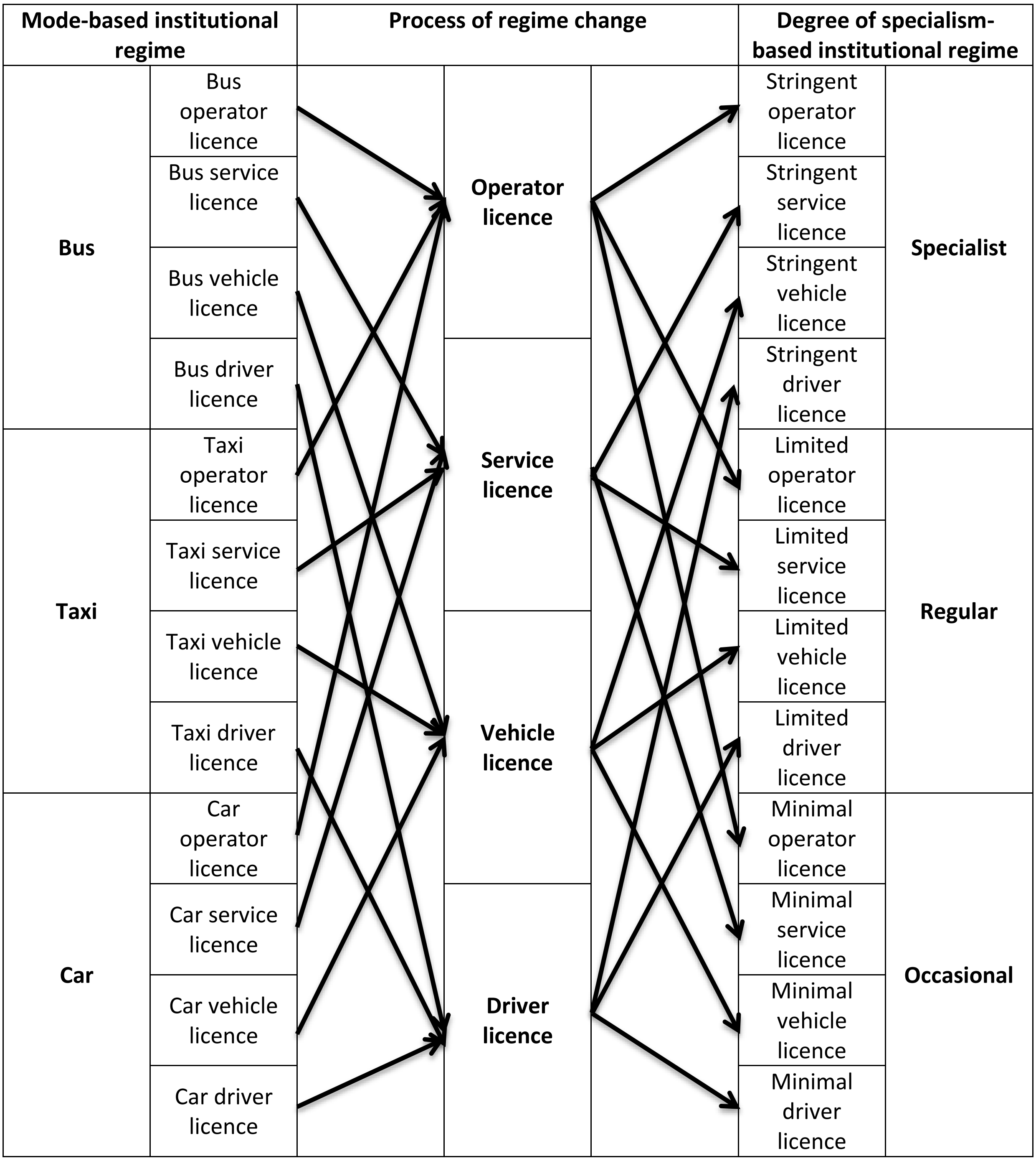

Figure 5: From a modal-based institutional structure to one based on operational specialism

Interestingly, although the strategic institutional set up would clearly look very different, it is not expected that the day to day functions of the various licensing authorities would change very much beyond their being re-organised and some minor refinements to allow for a broader interpretation of the service configurations that may be allowed. On the other hand, as already alluded to, it is recognised that such a major regulatory redesign would require deft political handling to ensure that those who stand to lose out from such reforms are adequately supported through the process. Yet such challenges are already having to be addressed even without such a change – one only need acknowledge the riots of taxi drivers in Paris protesting against the rise of Uber whilst this chapter is being written to illustrate this point (Arthur, 2015). Indeed, it could be argued that proactive change could actually serve to mitigate the situation before such disturbances against innovative services become an even more common occurrence than at the moment.

Ultimately, as in any system transformation, existing transport systems, actors and businesses would be replaced and new ones created. Small vehicle services represent a design that could yield substantial system-level energy, environmental and social benefits. But with entrenched actors within the structure of the existing system architecture, the politics and conflicts are only just starting. This needs to be recognised now, and understanding and partnerships need to be built so that both new and existing actors can have a stake in shaping our transport future.

Overall then, a new regulatory structure is needed. This is one that would maintain the various minimum standards required for a transport system to function safely, efficiently and effectively, but that would allow for new and more customer-appropriate models to develop, so overcoming the current institutional inertia that has hamstrung the transport sector in what is a rapidly changing world.

References

Arthur C (2015) Uber backlash: taxi drivers' protests in Paris part of global revolt, The Guardian, 26 June. Visit http://www.theguardian.com/technology/2015/jun/26/uber-backlash-taxi-drivers-protests-paris-global-revolt. Last accessed 30 June 2015.

Balcombe R, Mackett R, Paulley N, Preston J, Shires J, Titheridge H, Wardman M and White P (2004) *The demand for public transport: A practical guide*, TRL Report 593, Transport Research Laboratory, Crowthorne, Berkshire.

Banister D (2005) *Unsustainable Transport*. Taylor and Francis, London.

Boeckel M, Sprunger B, Smith K and Work E (2012) Uber – how a technology firm is changing the traditional transportation model. Kellogg School of Management, Northwestern University, Evanston IL, February. Visit: http://webcache.googleusercontent.com/search?q=cache:IOuMfcR_bw0J:www.kellogg.northwestern.edu/faculty/greenstein/ftp/teaching/papers/Uber%2520and%2520strategy.docx+&cd=2&hl=en&ct=clnk&gl=uk. Last accessed 30 June 2015.

Burns L D (2013) Sustainable mobility: A vision of our transport future, *Nature*, May, **497,** 181-182.

Cervero R (1997) *Paratransit in America: Redefining Mass Transportation*, Praeger, Westport.

Daganzo C F (2010) *Public transportation systems: Basic principles of system design*, Institute of Transport Studies, University of California Berkeley, Berkeley CA.

Davison L J, Enoch M P, Ryley T J, Quddus M A and Wang C, (2014) A survey of Demand Responsive Transport in Great Britain, *Transport Policy*, **31**, 47-54.

Enoch M P (2003) Transport practice and policy in Mauritius, *Journal of Transport Geography*, **11**(4), 297-306.

Enoch M P (2015) How a Rapid Modal Convergence into a Universal Automated Taxi Service could be the Future for Local Passenger Transport, *Technology Analysis and Strategy Management*, forthcoming.

Hall P (2013) Refreshing the parts that other transport cannot reach, *Town and Country Planning*, March, 121-132.

National Travel Survey (2014): *Statistical Release: National Travel Survey England 2013*, Department for Transport, 29 July.

Newman P W G, and Kenworthy J R (1999) *Sustainability and cities: Overcoming automobile dependence*, Island Press, Washington DC.

Nilsson J (2015) Will Uber Share the Jitney's Fate? *Saturday Evening Post*, 5 February. Visit http://www.saturdayeveningpost.com/2015/02/05/history/post-perspective/will-uber-share-jitneys-fate.html. Last accessed 24 June 2015.

Porter G (2015) Deeside Industrial Park shuttle bus 'unsustainable' say Flintshire council, *Daily Post*, 17 May. Visit http://www.dailypost.co.uk/news/north-wales-news/deeside-industrial-park-shuttle-bus-9269273. Last accessed 30 June 2015.

Rodoulis S (2014) *The impact of autonomous vehicles on cities, Journeys: sharing urban transport solutions*, Land Transport Academy, Singapore, 12-19.

Stagecoach (2015) Bus Industry Frequently Asked Questions, Stagecoach. Visit http://www.stagecoach.com/media/faqs/bus-industry-faqs.aspx. Last accessed 24 June 2015.

Trudel M (1998) The Taxi as Transit Mode. The City of Rimouski Demonstration with the Taxibus. Paper presented at the Annual Conference of the International Association of Transportation Regulators (IATR), Miami, 3 November.

Vuchic V R (2007) *Urban transit systems and technology*, Wiley, London.

Wang C, Quddus M A, Enoch M P, Ryley T J and Davison L J (2015) Exploring the propensity to travel by Demand Responsive Transport in the rural area of Lincolnshire in England, *Case Studies in Transport Policy*, **3**, 129-136.